Transection of the brachial artery after closed posterior elbow dislocation

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Although elbow dislocations are common orthopaedic lesions, vascular complications remain rare. We report the cases of three patients who presented with a rupture of the brachial artery after closed posterior dislocation, which is even more uncommon. Arteriograms were performed in all cases because of the persistent absence of pulses at the wrist after emergency reduction. In each patient, the treatment consisted of the insertion of reversed end-to-end saphenous bridges. None of them presented mid-term vascular complications (mean follow-up, 17 months). Brachial artery disruption can result from closed posterior elbow dislocation and responds well to vascular repair. (J Vasc Surg 2005;42:1230–2.)

Arterial injuries occur in 5% to 13% of elbow dislocations, mostly in cases of open dislocations or penetrating injuries.[1,2] Closed dislocations are rarely associated with vascular injury, especially in the absence of an accompanying fracture. Transection of the brachial artery after blunt trauma is extremely rare.[1,2] Since 1913, only a few isolated cases of closed posterior elbow dislocation with transection of the brachial artery have been reported in the medical literature, with differences of opinion as to the best management.[3-8] We report three cases of transection and the satisfactory nature of the vascular and functional mid-term results after operative vascular repair.

CASE REPORTS

Between January 2003 and January 2005, 3 (4.3%) of 70 patients with elbow dislocations presented a closed posterior dislocation associated with brachial artery transection.

Patient 1. A 30-year-old man sustained a closed posterior dislocation of his right elbow while playing rugby (Fig 1, *A and B*). His hand was cold but well colored. Radial and ulnar pulses remained absent after reduction. An arteriogram revealed occlusion of the brachial artery, with collateral circulation around the elbow (Fig 1, *C and D*). During surgical exploration, the brachial artery was found to be transected at the level of the biceps aponeurosis (Fig 2, *A*). Repair consisted of the placement of a brachiobrachial end-to-end reversed saphenous bridge (Fig 2, *B*). The time for revascularization was 19 hours. A 90° external fixation was put in place because of elbow instability. Twenty-three months after the accident, the patient does not present any sequelae.

Patient 2. After being struck by a motor vehicle, a 56-year-old man was transferred with closed posterior dislocation of the elbow complicated by acute ischemia. Despite emergency reduction, the wrist had no discernible pulse. An arteriogram revealed a complete interruption of flow in the brachial artery, with no evident collateral circulation. A transection of the brachial artery at the level of the biceps aponeurosis and laceration of the median nerve were revealed at the surgical exploration. A fasciotomy was performed because of tensed compartments of the forearm, followed by revascularization with a brachiobrachial reversed saphenous vein end-to-end bridge. The time for revascularization was 8 hours. The joint was maintained with a 90° posterior splint. Fourteen months later, the hand and arm functioned normally except for a 20° loss of extension.

Patient 3. A 49-year-old man presented a posterior dislocation of the elbow, without associated fractures, after a motorcycle accident. No radial or ulnar pulses were palpable. No signs of acute ischemia or neurologic deficit were noticed. Radial and ulnar pulses remained absent after reduction. The arteriogram revealed occlusion of the distal brachial artery with collaterals filling the ulnar artery just below the bifurcation. The brachial artery was found to have a transection at the level of the biceps aponeurosis. The median nerve was intact. The artery was repaired with a brachiobrachial reversed segment of saphenous vein, anastomosed end-to-end. The time for revascularization was 10 hours. The elbow was stable. His arm was maintained with a 90° posterior splint. Four months later, the graft is patent and the patient is asymptomatic. He is still undergoing physiotherapy.

DISCUSSION

Since the first report of brachial artery transaction after closed elbow dislocation, only a few isolated cases have been reported with different management and outcomes[3]: 1 patient had a successful recovery after direct ligation, 2 patients after conservative treatment, 17 after venous bypass, and 4 after direct suture.[1,9,10]

Closed reduction has to be the first emergency procedure, followed by repeated vascular examinations. The absence or weakness of pulses at the wrist must raise the suspicion that an arterial injury has occurred, and the diagnosis of arterial spasm should not be accepted as the cause of an ischemic-appearing limb The gold standard by which to evaluate injuries to the brachial artery remains angiography because duplex sonography is not easily performed on an injured limb.[1,11]

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Competition of interest: none.

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0741-5214/$30.00

doi:10.1016/j.jvs.2005.07.046

Fig 1. A-B, Plain elbow radiograph demonstrates a posterior dislocation of the elbow. **C-D,** Angiogram demonstrates the interruption of flow in the distal segment of the brachial artery, with collaterals filling the ulnar artery just below the bifurcation.

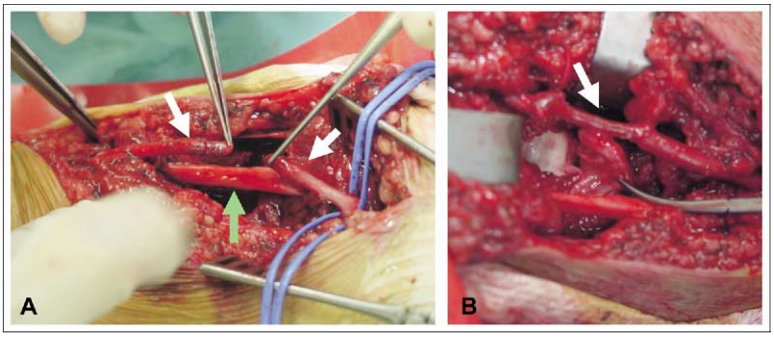

Fig 2. A, Operative photographs demonstrate the complete disruption of the brachial artery, whereas the median nerve remains intact. The *white arrow* indicates the brachial artery with transaction; the *green arrow* demonstrates the median nerve. **B,** Operative photographs demonstrate the placement of an interposed reversed saphenous vein to bridge the traumatic defect in the native brachial artery. The *white arrow* demonstrates the venous bypass.

The transection of the brachial artery, following blunt trauma, can be explained by the anatomy of the arm.[11,12] The brachial artery is more vulnerable to injury at its distal end, because in case of posterior elbow dislocation, this portion may be trapped between the rigid bicipital aponeurosis (inserted on the distal part of the humerus and on the proximal part of the radius) and the dislocated bony structures, particularly the distal part of the humerus. As was the case in two of our three patients, severe acute ischemia is not inevitable in the case of brachial artery disruption, and the diagnosis of arterial damage may not be evident because the collateral circulation around the elbow can mask findings of acute arterial occlusion, with the accompanying risk of a delayed diagnosis.

The collateral circulation around the elbow involves seven vessels as represented in Fig 3. The collateral circulation explains why ligation of the brachial artery at the elbow could have been performed after vascular injury without deleterious effect[13] and why delayed operative management is not always linked with bad prognosis.

Nevertheless, the anatomic studies by Louis et al[14] supported vascular repair. They studied the patency of the arterial collateral circulation after elbow dislocation in cadavers and demonstrated that, in all cases, at least one collateral anastomosis was disrupted. Moreover, most patients with elbow dislocation have swelling and bruising, which may compromise the collateral circulation and impair the blood flow.[2] Despite the extensive collateral circulation, many investigators have also expressed concern about the possible consequences of decreased distal perfusion after ligation of the brachial artery, including cold intolerance, claudication of the forearm and hand, and gangrene.

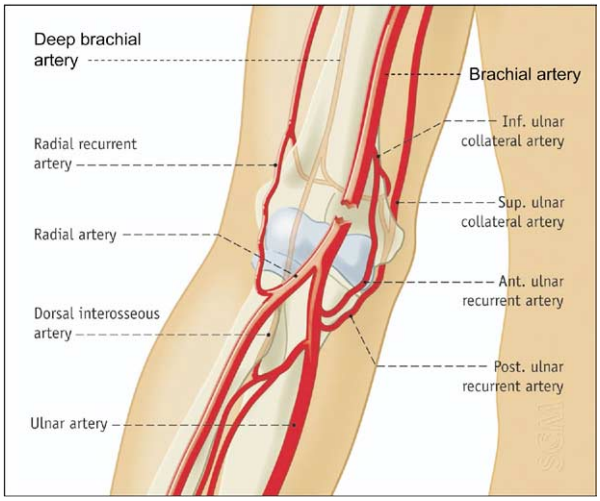

Fig 3. Drawing demonstrates the arterial collateral circulation around the elbow involving the deep brachial artery and the dorsal interosseous artery, the anterior ulnar recurrent artery and the inferior ulnar collateral artery, the posterior ulnar recurrent artery and the superior ulnar collateral artery, and the radial recurrent artery.

Primary repair is usually impossible because of lack of length after débridement. The native vessel should be preferably bridged with the greater saphenous vein harvested from an uninjured extremity. The three brachiobrachial bypasses were performed with the elbow in nearly complete extension through a curved incision over the anterior part of the elbow. The bypasses appeared to be performed across the joint in extension and just above the elbow knee in flexion. No kink was observed with a 90° flexion, and the joints were immobilized in this position after an arteriogram was performed so as to detect any distal thrombus or any anastomotic defect.[11] After removal of the external fixation, progressive mobilization was performed without any vascular problem.

Fasciotomy is indicated in cases of elevated pressure in the forearm compartment, extended delay between injury and repair, or severe soft tissue injury. Elbow stability must be tested after joint reduction. If the elbow is stable through the entire arc of motion, then no surgery is needed. The elbow can be immobilized in a posterior splint for 2 weeks. If the elbow remains unstable, the lateral collateral ligaments must be repaired, and sometimes protected, with an articulated external fixator.[15]

CONCLUSION

Early diagnosis and operative repair of the injured brachial artery seems to be the only acceptable treatment. A surgical approach allows for a complete exploration of associated injuries and for arterial repair at the same time. Finally, in spite of prolonged time to revascularization, the mid-term results were satisfactory in our patients. Brachial artery disruption can result from closed posterior elbow dislocation and responds well to vascular repair.

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Submitted May 18, 2005; accepted Jul 13, 2005.